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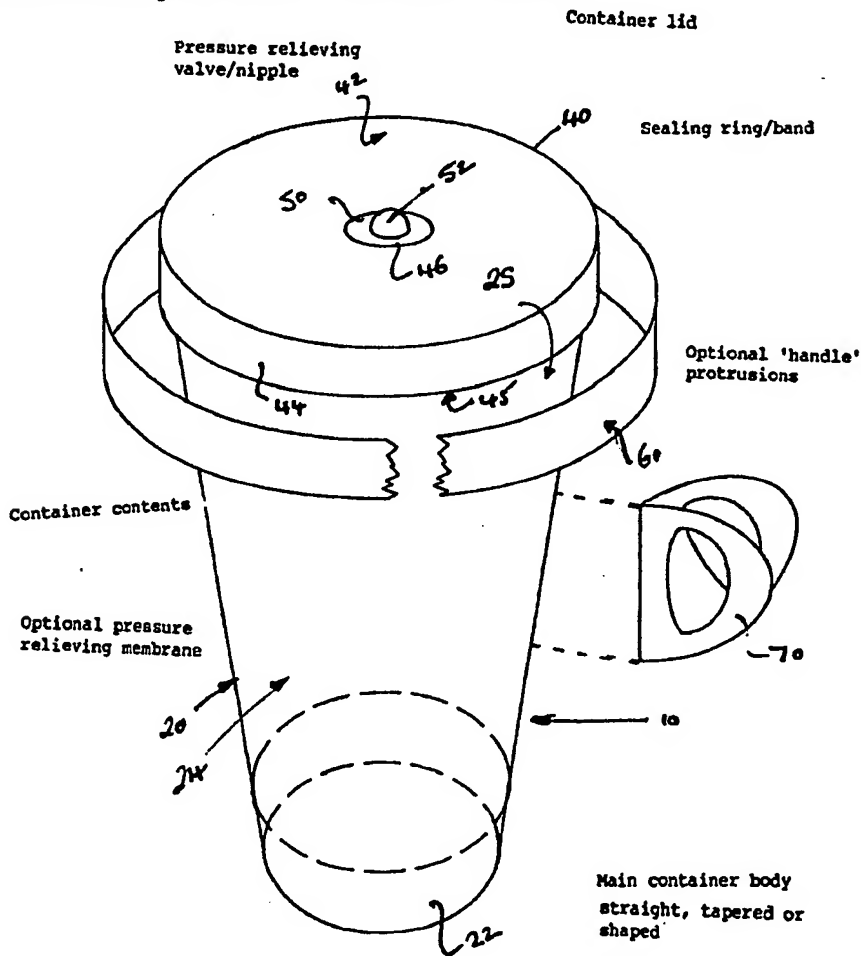
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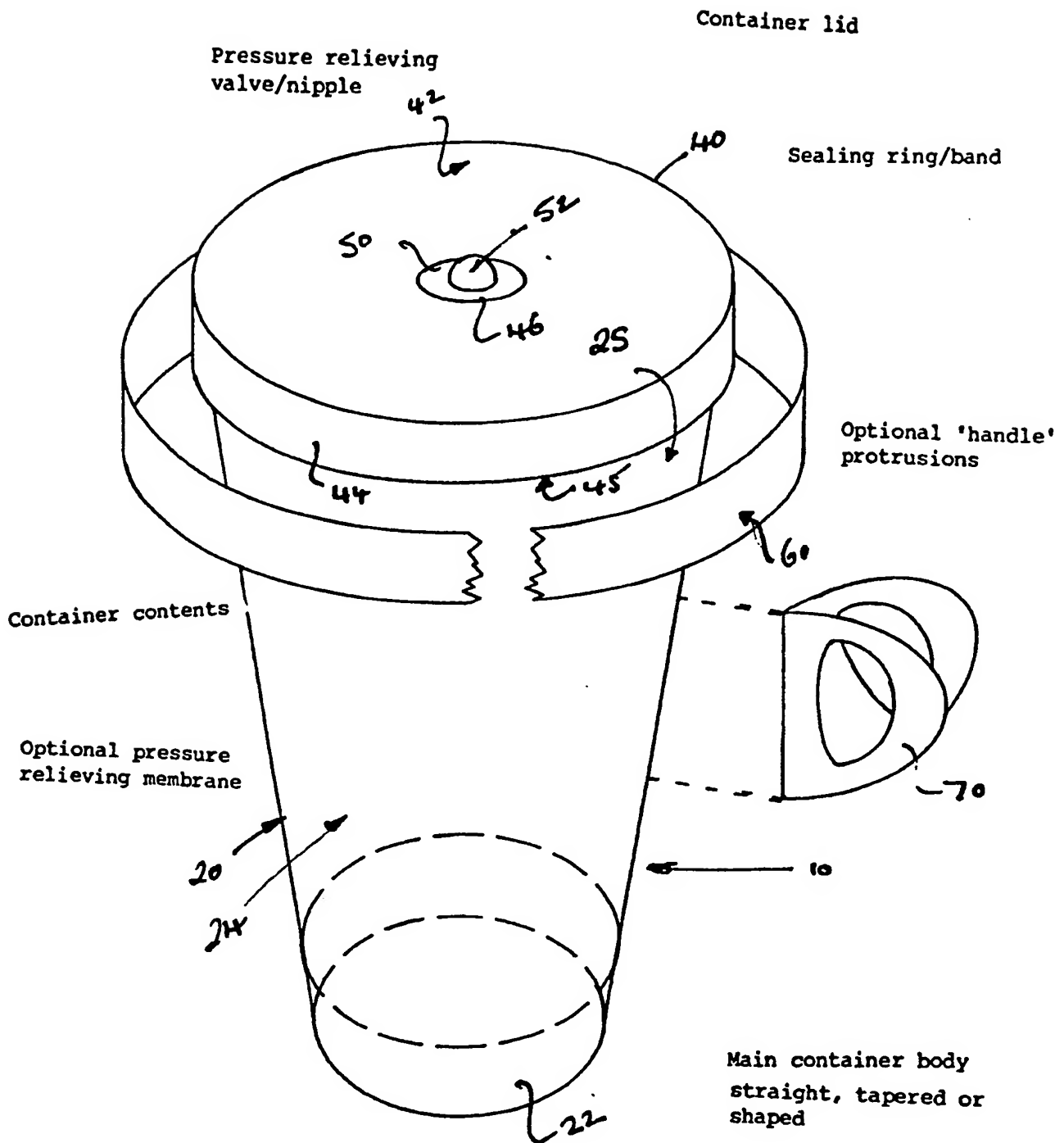
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(57) An air tight container in which preserved food or drink may be heated by microwave is formed from substantially rigid or semi-rigid components.

The container may be subject to microwave heating with or without the removal of a container seal 60 or lid 40 and a pressure relieving valve mechanism 50 may be provided.





AIR-TIGHT CONTAINER

The present invention relates to a substantially rigid or semi-rigid, air-tight container, and has particular reference to containers for storing
5 preserved drinks, such as beverages, and preserved foods of a fluid or partially fluid nature for subsequent heating by microwave irradiation.

10 The use of microwave radiation to effect heating of food and drink is well-known, and many commercial and domestic kitchens include a microwave oven which is typically used for re-heating and/or de-frosting purposes. With a few exceptions, however, microwave
15 heating is generally unsuitable for cooking raw food as opposed to merely re-heating, because microwave radiation by itself does not procure the desired amount of crisping and/or browning of many types of food.

20 Many solutions to this problem have been proposed in the prior art. For example United States Patent Specifications Nos. 4230924 and 4267420 each disclose

a flexible wrapping for food which is capable of being manipulated to conform at least to a portion of an article of food. The wrapping comprises a dielectric substrate which carries a relative thin film of lossy material such, for example, as aluminium on a surface of the substrate. While a major proportion of microwaves incident on the wrapping pass through the wrapping, a minor proportion interacts with the lossy material which converts the energy of the microwaves into heat to effect crisping and/or browning of the wrapped food.

United States Patent Specification No. 4190757 discloses a package for food which includes an assembly of dielectric and lossy components. The package of US 4190757 is adapted to accommodate for storage and subsequent microwave heating food of a substantially non-fluid nature such as savoury or fruit pies, sandwiches and cuts or fillets of meat or fish.

There is, however, a requirement for a container for storing drinks such, for example, as beverages and food of a fluid or partially fluid nature for extended

periods of time under air-tight conditions, which container can be used to contain the drink or food during the course of microwave heating so as to obviate the requirement for decanting the drink or food into a different container or receptacle.

The applicant envisages that such a container would be particularly suitable for storing preserved beverages such as tea and coffee as well as preserved drinking soups and preserved foods such as beans or pasta in various types of sauce and custard. In particular, the applicant perceives that such a container would meet a long-felt need in the provision of "fast-food" eg. in road-side service stations as well as other self-service "fast-food" retail outlets.

Furthermore, such a container may find application outside the food industry for storing non-edible fluid materials which are required to be heated in a microwave.

According to one aspect of the present invention, therefore, there is provided a substantially rigid or semi-rigid, air-tight container adapted for storing

preserved food or drink of a fluid or partially fluid nature; characterised in that said container comprises a receptacle portion formed from a substantially rigid, temperature resistant material having a low loss angle with respect to microwave radiation; wherein said preserved food or drink can be stored in said container over extended periods of time and subsequently heated in the receptacle portion by microwave heating without degradation of said material or contamination of said food or drink.

By the term "substantially rigid or semi-rigid, as used herein is meant that the container is sufficiently strong and dimensionally stable that said preserved food or drink can be stored in said container over an extended period of time, with little or no risk of the container being damaged e.g. punctured thereby derogating from the air-tight nature of the container and allowing deterioration of said preserved food or drink. Furthermore, the rigidity of the receptacle portion allows the receptacle portion to be handled easily for heating and consuming the food or drink. It will be understood that, in accordance with the present invention, the food or

drink may be heated in, and consumed directly from the receptacle portion in which the food for drink is stored. In some embodiments, the receptacle portion may be shaped ergonomically for consuming the food or
5 drink; the receptacle portion may be shaped e.g. as a cup, mug or bowl. In one aspect the receptacle portion may comprise handle means to facilitate handling of the receptacle portion particularly after heating when the contents may be hot.

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It will be understood that the present invention includes any suitable material known to a person skilled in the art, but, in one aspect, said material may be selected from polyester, polypropylene or other
15 dielectric plastics materials, glass, ceramic, cardboard or paperboard and composite dielectric materials.

The material may have a low loss angle with respect to
20 microwave radiation having a frequency in the range 1500 - 3500 MHz; typically the microwave radiation may have a frequency of 2000 - 3000 MHz. In one embodiment the microwave radiation may have a frequency of about 2500 MHz.

Said container may further comprise a closure portion.
Said closure portion may be detached or removed from
the receptacle portion prior to or after heating.

5 In another aspect of the present invention there is
provided a substantially rigid or semi-rigid,
air-tight container for storing preserved food or
drink of a fluid or semi-fluid naturem said container
comprising a receptacle portion adapted for
10 accommodating said food or drink and a closure portion
therefor, characterised in that:-

(i) said receptacle portion is formed from a
substantially rigid or semi-rigid temperature
15 resistant material having a low loss angle with
respect to microwave radiation.

(ii) sealing means is provided between the
closure portion and the receptacle portion to
20 render the closed container air tight, thereby
to permit the storage of said food or drink for
an extended period of time, and

(iii) pressure relief means is provided in the closure portion and/or the receptacle portion; the arrangement being such that when the container and contents are heated by microwave radiation, any excess pressure built up in the
5 receptacle portion is vented by the pressure relief means, thereby negating the need to remove the closure portion prior to heating.

10 The closure portion may be formed integrally with the receptacle portion. Said sealing means may comprise a region of weakness between the receptacle portion and the closure portion. In some embodiments, the closure portion may form a tear-off portion of the
15 container. Said region of weakness may comprise a single line of air-tight partial perforations between the closure and the receptacle portion. Alternatively, the region of weakness may comprise two parallel spaced lines of weakness defining a tear-strip or
20 elongate tear-tab. The tear-strip or tab may comprise a protruding portion constituting a "start" tab.

The closure portion may, in one aspect of the invention, be formed from the same material as said receptacle portion.

5 In a different aspect of the invention the closure portion may be formed separately from the receptacle portion. Said closure portion may form a screw- or press- fit with the receptacle portion. In one embodiment, the sealing means may include lipping
10 means on the closure portion and means on the receptacle portion adapted to cooperate with said lipping means to form an air-tight seal.

In one aspect, the closure portion may comprise a
15 metal cap or lid which must be removed prior to microwave irradiation. The metal cap may be formed of aluminium or anodized or enamelled steel.

In a different aspect, the closure portion may be
20 formed of a non-lossy material having a low loss angle with respect to said microwave radiation.

In yet another aspect of the invention, the closure portion may be fused to the receptacle portion to form a hermetic seal therewith.

5 Said sealing means may include a sealing strip or tape adapted to form an air-tight seal between the receptacle portion and the closure portion. Said strip or tape may be adapted to overlay the external surface of the container at the interface between said
10 receptacle portion and said closure portion. In some embodiments, said strip or tape may form a shrink-fit on said container. In one aspect of the invention, the sealing strip or tape may be susceptible to physical and/or chemical degradation by microwave
15 radiation whereby removal of the strip or tape may be facilitated by microwave irradiation.

Said material may be a composite material. In one aspect of the invention, the material may include a
20 fluid resistant layer or lining on the inside of said receptacle, thereby to prevent seepage of penetration of said food or drink into said material. In another aspect, the material may be impregnated with a dielectric sealing or fluid-repelling material thereby

to render said material resistant to said food or drink. It will be appreciated however that said sealing or fluid-repelling material must be resistant to microwave radiation to avoid contamination of the food or drink in the receptacle by leaching of the sealing material. Similarly, it will be appreciated that where the material is a plastics material, said material may include a plasticizer provided that said plasticizer does not contaminate the food or drink during storage, or subsequent heating and consumption.

Typically, the pressure release means may be included in said closure portion. Said pressure release means may be selected from manually operable venting means, self-sealing venting means and rupturing membrane release means. Said manually operable means may comprise an aperture formed in said closure portion, which aperture is closed with a frangible film or sheet to form an air-tight seal. Said frangible film or sheet may be ruptured prior to heating using a sharp implement such, for example, as a knife. Alternatively, said venting means may comprise a tear-off tab which may be released by hand prior to

heating to reveal or form an aperture in said closure portion.

Said self-sealing venting means may comprise a
5 pressure release valve or nipple which operates when
the pressure in said container exceeds a predetermined
threshold pressure. Said rupturing membrane venting
means may comprise an aperture formed in said closure
portion, which aperture is sealed by a film or sheet
10 having a predetermined tensile strength, whereby said
film or sheet is caused to rupture irreversibly when
the pressure acting thereon in the container exceeds
said strength. In a different aspect, said rupturing
membrane means may comprise a frangible film or sheet
15 which extends across the interior of the receptacle to
form a hermetic partition which divides said
receptacle into a food/drink containing portion and a
closed, empty portion. If and when the pressure in
the food portion exceeds the pressure in the empty
20 portion, said film or sheet may be caused to rupture
thereby allowing the pressure in the food containing
portion to be released into said empty portion.

In yet another aspect, the receptacle portion may be closed with a thin hermetically sealed film or sheet. Said closure portion may overlay said film or sheet to protect the latter during storage and/or display of the container. It will be understood that said film or sheet may include pressure release means in addition to, or as an alternative, to said pressure release means in said closure portion.

It will be appreciated therefore that the present invention provides a substantially rigid or semi-rigid container which is suitable for storing preserved food and drink over an extended period of time. The container includes a receptacle portion which accommodates the food or drink and is formed of a non-lossy material so that the food or drink can be heated in the receptacle portion by microwave irradiation without having to decant the food or drink into a different container for heating. Furthermore, the heated food or drink may be consumed directly from the receptacle portion.

Typically, the container may include a closure portion which forms an air-tight seal with the receptacle portion via sealing means. The closure portion may typically be provided with pressure-release means which allows said food or drink to be heated in the receptacle portion by microwave heating without having to remove or open the closure portion, any excess pressure built-up in the container during heating being vented by said pressure release means.

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Following is a description by way of example only and with reference to the accompanying drawings of methods of carrying the present invention into effect. In the drawings, Figure 1 is a perspective side view of a container in accordance with the present invention.

15

In Figure 1, a container (10) comprises a receptacle portion (20) and a closure portion (40) adapted to mate with the receptacle portion (20). Said receptacle and closure portions (20) (40) are each formed from a substantially rigid, heat resistant thermoplastic material which has a low loss angle with respect to microwave electromagnetic radiation having a frequency of about 2500 MHz e.g. polypropylene or polyester.

20

The receptacle portion (20) includes a circular base (22) and an upstanding frusto-conical wall (24) which terminates at its upper end (25) in an annular rim (26) (not shown).

5

The closure portion (40) comprises an annular crown (42) formed with a depending, peripheral cylindrical skirt (44) which terminates at its lower end in an annular rim (45). The internal diameter of said skirt (44) is slightly less than the external diameter of the wall (24) at said upper end (25), so that said skirt (44) forms a tight-fit with said upper end (25) when the closure portion is mated with the receptacle portion by entering said skirt (44) over the upper end of the wall (24) and pushing the closure portion (40) downwardly with respect to the receptacle portion until rim (26) abuts on the underside of crown (42).

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Said annular crown (42) defines a central hole (46) which accommodates a self-sealing pressure release device (50) of the type well known to a person skilled in the art, which pressure release device (50) includes a pressure release valve or nipple (52) which operates when the pressure in the container exceeds a

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predetermined threshold pressure. The device (50) is secured in the hole (46) by an air-tight seal formed of microwave resistant material.

5 Said container (10) also comprises a sealing strip or tape (60) which is formed from an air-tight, non-lossy material. When the closure portion (40) is fitted on the receptacle portion (20), said strip or tape (60) is placed around the circumference of the container so
10 that it overlays the lower rim of the skirt (44) and the juxtaposed portions of said skirt (44) and said wall (24). The strip or tape (60) is then subjected to a heat treatment so that it shrinks onto the surface of the container to form an air-tight seal
15 between the closure portion (40) and the receptacle portion, and to hold the two portions together against any internal positive pressure in the container.

20 The container (10) also includes a handle portion (70) which is carried by the external surface of wall (24).

Said container is adapted to contain preserved drink or preserved food of a fluid or partially fluid nature. The preserved food (or drink) is charged into the receptacle portion (20) under sterile conditions, and the closure portion (40) and sealing tape or strip are then fitted successively as hereinbefore described to form a hermetic seal between the receptacle portion (20) and the closure portion (40).

As a result of the rigidity of the container, the food (or drink) can be stored in the container for an extended period of time before consumption. In order to heat the food, the whole container may be placed in a microwave oven and irradiated with microwave radiation having a frequency of about 2.5 GHz for a predetermined period of time. If the pressure in the container during heating exceeds the threshold of the pressure-release device (50), the valve or nipple is automatically operated to release the pressure whereupon the pressure in the container falls back below said threshold thereby allowing said valve or nipple to close. The valve or nipple may open and close several times during the heating stage.

When said food (or drink) has reached the desired temperature for consumption, the container is removed from the microwave oven, and the sealing tape or strip (60) is removed by any convenient method e.g. cutting or tearing. Thereafter the closure portion (40) is removed by hand, and the food (or drink) may be consumed directly from the receptacle portion (20). It will be appreciated that the rigidity of the receptacle portion (20) renders it sufficiently dimensionally stable to be handled easily to consume the food or drink.

CLAIM

This invention related to a container for the containment and microwave heating of preserved foods and/or liquids.

According to one aspect of the present invention, therefore, there is provided a substantially rigid or semi-rigid, air-tight container adapted for storing preserved food or drink of a fluid or partially fluid nature; characterised in that said container comprises a receptacle portion formed from a substantially rigid, temperature resistant material having a low loss angle with respect to microwave radiation; wherein said preserved food or drink can be stored in said container over extended periods of time and subsequently heated in the receptacle portion by microwave heating without degradation of said material or contamination of said food or drink.

In another aspect of the present invention there is provided a substantially rigid or semi-rigid, air-tight container for storing preserved food or drink of a fluid or semi-fluid nature, said container comprising a receptacle portion adapted for accommodating said food or drink and a closure portion therefore, characterised in that:-

- (i) said receptacle portion is formed from a substantially rigid or semi-rigid temperature resistant material having a low loss angle with respect to microwave radiation.
- (ii) sealing means is provided between the closure portion and the receptacle portion to render the closed container air tight, thereby to permit the storage of said food or drink for an extended period of time, and
- (iii) pressure relief means is provided in the closure portion and/or the receptacle portion; the arrangement being such that when the container and contents are heated by microwave radiation, any excess pressure built up in the receptacle portion is vented by the pressure relief means, thereby negating the need to remove the closure portion prior to heating.

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(ii) Int Cl (Ed.5) H05B 06/08; B65D 51/16, 81/34; A47J 27/08	Date of completion of Search 21 FEBRUARY 1994
Databases (see below)	Documents considered relevant following a search in respect of Claims :- SEE REPORT
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.	
(ii) ONLINE DATABASES; WPI, EDOC, CLAIMS, INSPEC	

Categories of documents

X: Document indicating lack of novelty or of inventive step.	P: Document published on or after the declared priority date but before the filing date of the present application.
Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.	E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A: Document indicating technological background and/or state of the art.	&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2222355 A (COURTAULDS) see whole document	
X	GB 2188520 A (HOUSE FOOD) see whole document	
X	EP 0438080 A1 (MATSUSHITA) see whole document	
X	EP 0416759 A1 (CEM) see whole document	
X	US 5053594 A (RICH-SEAPAK) see whole document, especially Figure 6 wrt removable strip	
X	US 5039001 A (KRAFT) see whole document	
X	US 4962944 A (GOURMEC) see especially Figures 2, 3	
X	US 4796776 A (NORTHLAND) see whole document	
X	GB 1021596 A (FOSTER GRANT) see venting arrangement	
X	GB 653023 A (DAVIES) see venting arrangement	

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).